Space Weather Technical Forecast

Issued on Monday, 27 May 2024 at 00:16 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: A risk of M-flares likely throughout, with the return of two previous large sunspots.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Low solar activity with the with peak flare a C7.4 from AR3691 at 26/1706 UTC. There are eight sunspot regions on the visible disk, five numbered with the most notable being AR3691 in the northeast. This moderately sized region is set within a broad plage region with some ongoing slow development visible, most notable to its northeastern periphery. The region also has a small delta spot within the northwestern most penumbral area. Across the rest of the disc, the regions remain smaller and simpler.

No Earth-directed Coronal Mass Ejections (CMEs) were observed in available imagery.

Solar Wind / Geomagnetic Activity: Background to slightly elevated solar winds speeds were observed by ACE at L1, varying between 350-450 km/s, with below average density. The Interplanetary Magnetic Field (IMF), Bt, was generally weak, around or below 8nT, with the north-south component, Bz, also weakly varying between +5nT and -5nT. Phi angle was initially mainly positive (away from the Sun). Geomagnetic activity was Quiet to Unsettled (Kp 1-3).

Energetic Particles / Solar Radiation: High energy proton flux at GOES18 (greater than 10 MeV) remained at Background. High energy electron flux (greater than 2MeV) at GOES16 remained at Background to Moderate levels. Associated 24-hour fluence remained below the Active threshold. Observed fluence at 27/0000 UTC was 5.93e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate activity expected, with isolated M-class flares likely and a slight chance of X-class flare, these most likely from AR3691 but perhaps also from the return of ex-AR3664 as it moves onto the southeast limb into the period.

Solar Wind / Geomagnetic Activity: A weak CME glance is possible early day 1 (27 May), although confidence is low. This is due to a filament eruption from the southeast disc on 23 May. Weak fast wind influences are also possible, most likely day 1 and into day 2 (27-28 May) from the southern coronal hole CH40/+. Otherwise mainly background slow wind conditions are anticipated. Mainly Quiet geomagnetic activity is expected, perhaps rising to give spells of Unsettled to Active conditions at times.

Energetic Particles / Solar Radiation: High energy proton flux is expected to be at background throughout. High energy electron flux is also forecast to persist at mainly background, The associated 24 hour fluence is expected to remain well below Active.

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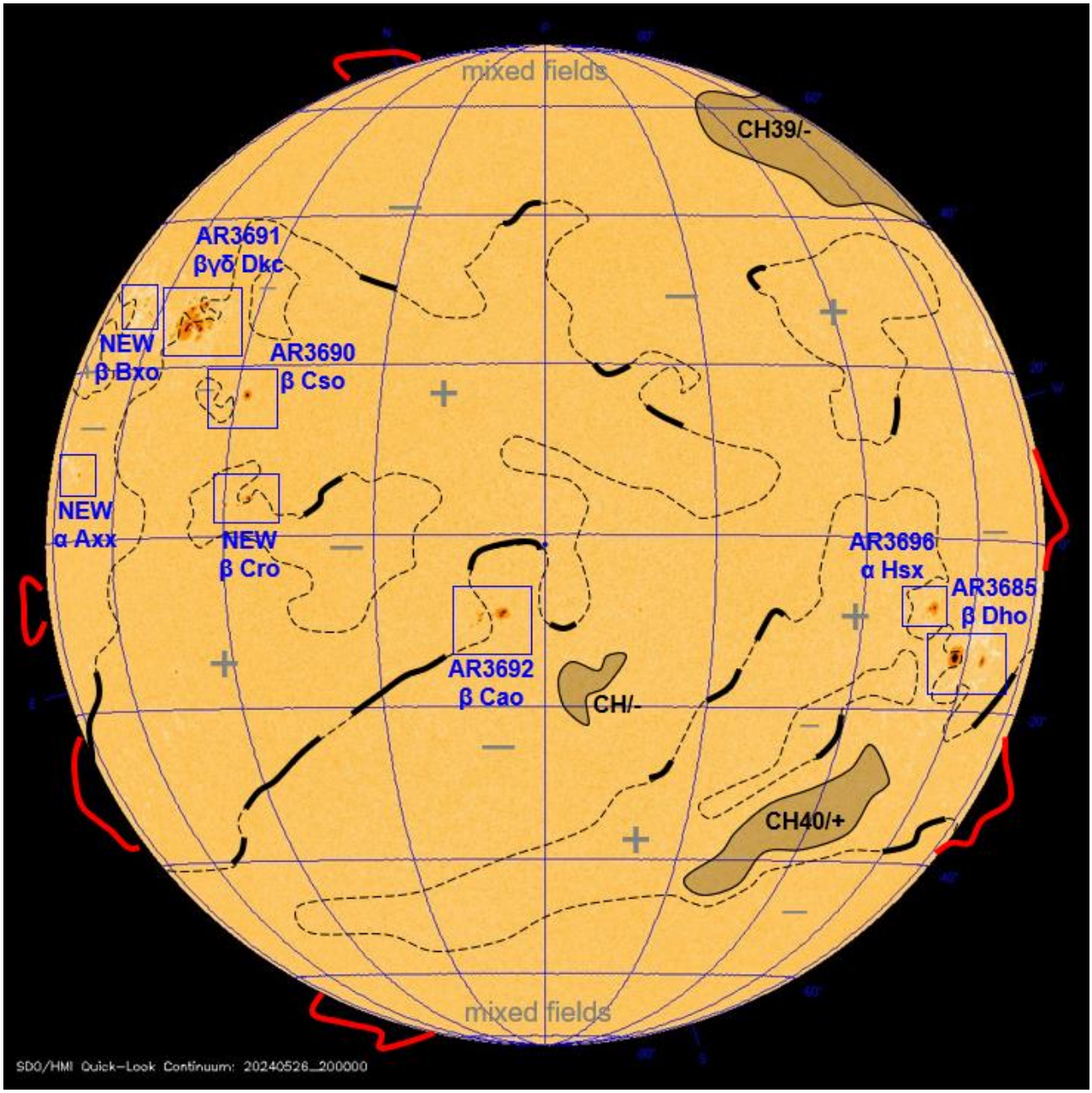
Figure 1. Solar Analysis Valid 26/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There is the potential for glancing impacts from a weak CME which left the Sun due to a filament eruption around 23/0600 UTC. This is low confidence, both due to its weak nature and due to imagery being contaminated with non-Earth-directed CMEs, however a weak arrival is indicated in MOSWOC ENLIL as possible early day 1 (27 May).

Otherwise, mainly background solar winds are expected to continue although some slight enhancements may occur in association with CH40/+ situated in the southern disc into day 1 or day 2 (27-28 May), although any such enhancement is both low confidence and likely be limited, with solar winds quickly returning to background.

Mainly Quiet geomagnetic activity is expected, perhaps rising to give spells of Unsettled to Active conditions at times, but with only a very slight chance of G1 Minor Storm with any CME arrival or coronal hole onset.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	5	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
23/1553	Partial	Filament	SE	320 km/s	27/0000 UTC +/- 12hrs	Low confidence, glancing impact

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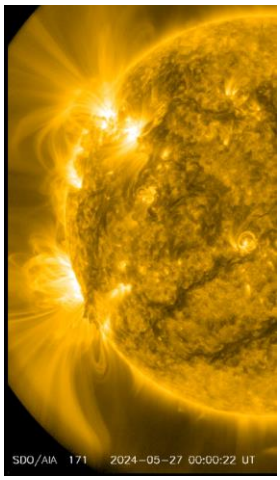
Radio Blackouts - X-Ray Flares:
Low to Moderate activity expected, with isolated M-class flares likely and a slight chance of X-class flare, these most likely from AR3691 but perhaps also from the return of ex-AR3664 as it moves onto the southeast limb.

Of the eight sunspot regions, AR3691 in the northeast represent the bulk of current flare risk, with the remaining regions all currently largely inactive. AR3691 is currently smaller and less complex than its likely previous incarnation as the active AR3663, but it lies within a broad plage area and extensive magnetic looping is evident in SDO imagery, with recent growth and a delta spot visible within the northern portion of the region hinting at the potential for further development of the region.

There is also the potential for the risk of flare activity to increase with the return of the extremely active ex-AR3664 onto the southeast limb. This most likely to occur through later day 1 and into day 2 (27-28 May), with the magnetic canopy of the region is now becoming visible in SDO imagery. While it remains uncertain how much of the region has persisted after its travels across the far-side, for now the flare risk is maintained through the period pending analysis of this feature/features.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	60	60	60	60
Very Active	R3 to R5 X Class	No	10	10	10	10

Figure 2: Recent SDO/AIA 171 imagery showing magnetic looping associated with AR3691 in the NE, and from most likely ex-AR3664 around the SE limb.



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Solar Radiation Storms - (High Energy Protons):
GOES-18 proton flux is currently at background, and is currently expected to persist at these levels through the period. The complex AR3691 in the northeast disc and possibility for another large sunspot region associated with ex-AR3664 to round the southeast limb into the period does maintain the risk above background levels however, given the risk of larger flares.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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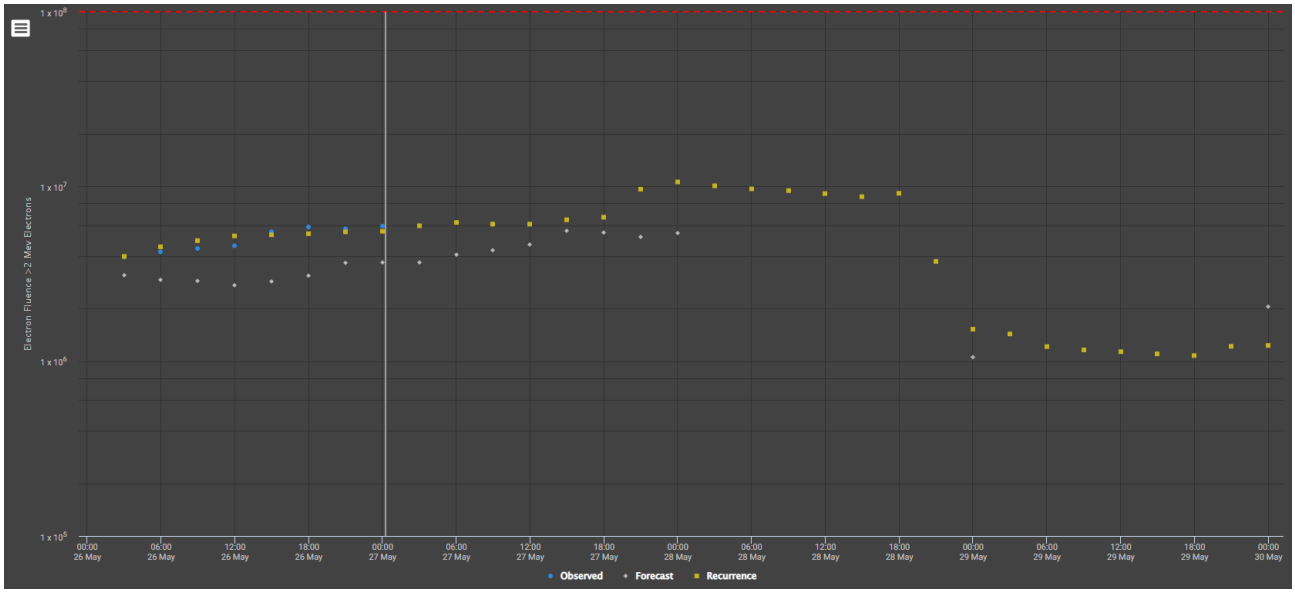
High Energy Electrons Event (≥ 2MeV):
GOES-16 electron flux is currently mainly background with only brief diurnal increases to Moderate possible. There is a slight chance of a weak connection to CH40/+ day 1-2 (27-28 May), and the potential for a weak CME glance early on day 1 (27 May). These are both likely to further suppress the electron population at GEO on onset, with little enhancement following. The associated 24 hour electron fluence is expected to remain below the Active level, as supported by MOSWOC REFM, which is currently providing good guidance for the expected trend.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 3: Latest MOSWOC REFM model output.



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